AD-A104 665 ARMY ENGINEER DISTRICT ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. ANDERSON LAKE DAM (MO 30410), MISS--ETC(U)
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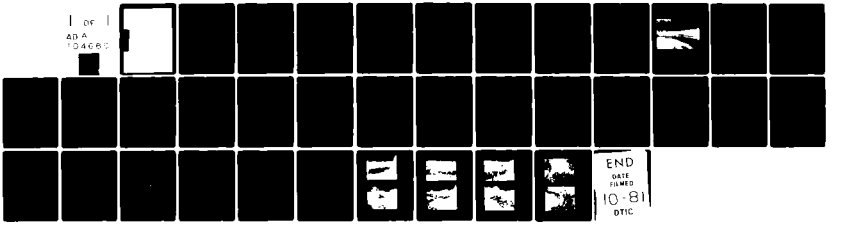

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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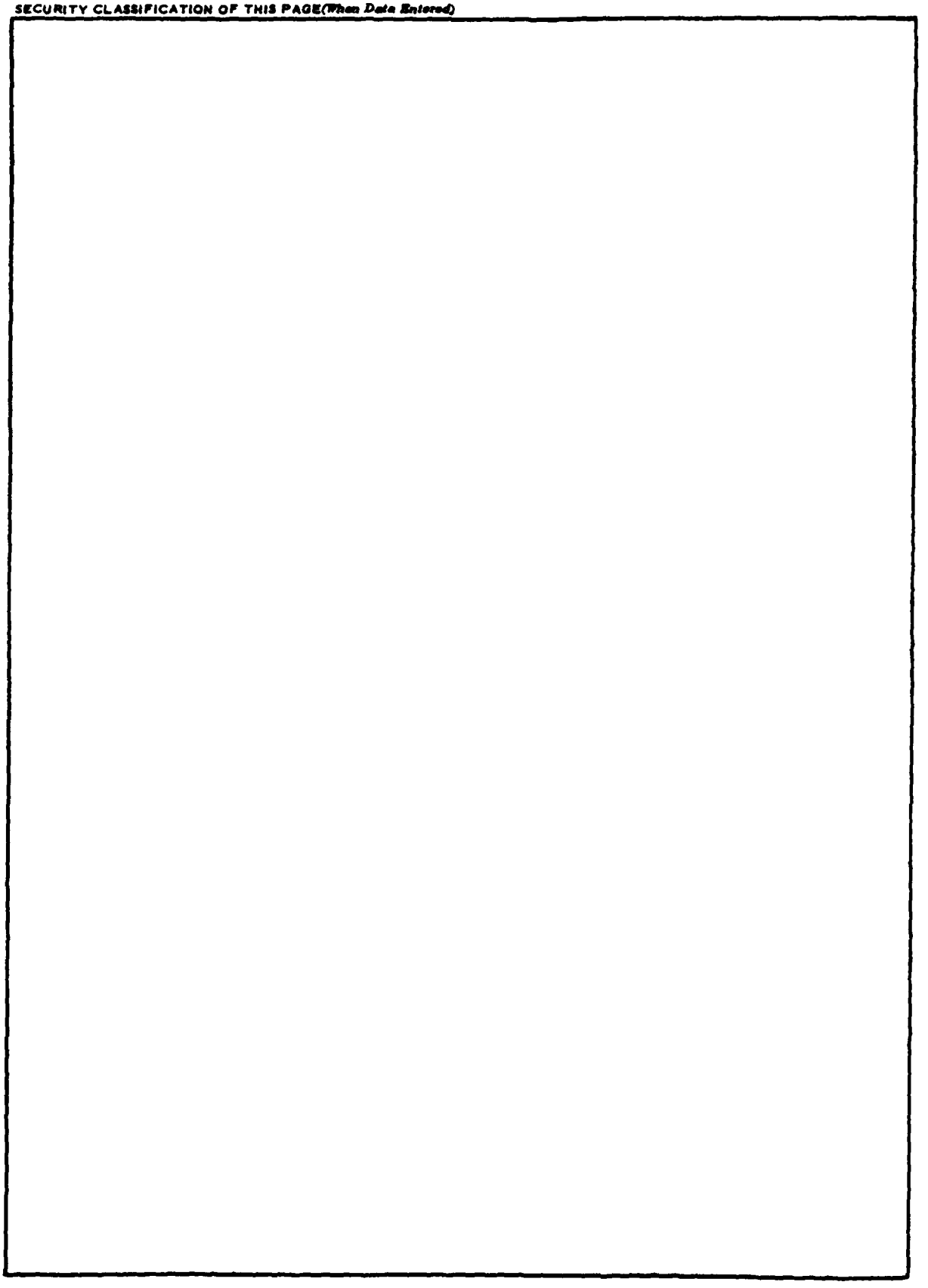

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ANDERSON LAKE DAM
JEFFERSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30410

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: ST. LOUIS DISTRICT CORPS OF ENGINEERS
FOR: GOVERNOR OF MISSOURI

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Anderson Lake Dam
State Located:	Missouri
County Located:	Jefferson County
Stream:	No Name
Date of Inspection:	7 September 1978

Anderson Lake Dam was inspected by an interdisciplinary team of engineers from the St. Louis District, U. S. Army Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property. The inspection and assessment were made using the "Recommended Guidelines for Safety Inspection of Dams" developed by the Chief of Engineers, U.S. Army, Washington, DC, with the help of several Federal and state agencies, professional engineering organizations and private engineers.

Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. Failure would threaten the life and property of approximately four families downstream of the dam and cause appreciable damage to one farm complex, one improved road and two unimproved roads, all within a three-mile damage reach of the lake.

For its size and hazard category, this dam is required by the guidelines to pass from one-half PMF to PMF. However, considering the high-hazard potential to life (four residences) and property downstream of the dam, the PMF is considered the appropriate spillway design flood. Since the spillway for the dam is not capable of passing a minimum of one-half (50 percent) of the PMF without overtopping the dam and causing failure, the spillway is considered seriously inadequate. The spillway is capable of passing 20 percent of the PMF without overtopping the dam.

Other deficiencies visually observed by the inspection team were a thick cover of trees and brush on both sides of the embankment slopes, lack of erosion protection from runoff on the downstream face of the left abutment, lack of erosion protection along the spillway channel and the upstream face of the embankments, and the exit channel flows along the toe of the embankment. Another

deficiency which should be corrected was the lack of seepage and stability analyses comparable to the requirements of the guidelines. However, none of these deficiencies present a serious threat to the dam's stability.

It is recommended that the owner take action to correct or control the deficiencies described. A detailed report discussing each of these deficiencies was prepared and submitted herewith.

for Freddie R. Buck P.E.
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SUBMITTED BY: for Arthur L. Dahlgren, Chief, Engineering Division — 20 Dec 78 Date

APPROVED BY: Leon E. Mick, Colonel, CE, District Engineer — 20 Dec 78 Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ANDERSON LAKE DAM - ID NO. 30410

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NATIONAL DAM SAFETY PROGRAM
ANDERSON LAKE DAM - ID NO. 30410

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Anderson Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure built in a narrow valley. The topography adjacent to the valley is rolling to steep. The earth embankment is composed of brown silty clay. Topography in the vicinity of the dam is shown on PLATE 2.

(2) The spillway, located on the right abutment, was cut in sedimentary rock. There are no outlet works or other structures controlling releases from the lake except for the spillway.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location: The dam is located in the southwestern portion of Jefferson County, Missouri, as shown on PLATE 1. The lake formed by the dam is located in the SW 1/4 of Section 7 of T40N, R4E of the Fletcher, Missouri Quadrangle Sheet.

c. Size Classification: Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the small size category.

d. Hazard Classification: Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.2c, above. Based on referenced guidelines, this dam is in the High Hazard Classificaton

e. Ownership. This dam is owned by Mr. Hugh Anderson.

f. Purpose of Dam. The dam forms a 5.2-acre recreational lake.

g. Design and Construction History. It was reported that the dam was built in 1958 by the previous owner. Plans for the construction of the dam were prepared but the present owner was unable to locate the design plans. The location of the previous owner is not known.

h. Normal Operating Procedure. No operating records exist. Outflow passes over an uncontrolled spillway.

1.3 PERTINENT DATA

a. Drainage Area - 93 acres

b. Discharge at Damsite: Not known

Maximum known flood at damsite - 1 foot depth over spillway reported

Spillway capacity at maximum pool elevation - 350 cfs

c. Elevation (feet Above m.s.l. from assumed benchmark of 700 ft. m.s.l.):

(1) Top of dam - 699.2

(2) Flood control pool - 699.2

(3) Recreation pool - 696.8

(4) Streambed - 673±

(6) Maximum tailwater - Not known

d. Reservoir:

Length of maximum pool - Approximately 1,200 feet

Length of recreation pool - Approximately 900 feet

e. Storage (Acre-feet):

Recreation pool - 57

Flood Control pool - 68

Design surcharge - 0

Top of dam - 68

f. Reservoir Surface Area (Acres):

Top of dam - 5.2

Maximum pool - 5.2

Flood control pool - 5.2

Recreation pool - 4.7

Spillway crest - 4.7

g. Dam.

Type - Earth fill.

Length - 335 feet.

Height - 26± feet

Top width - 10 feet.

Side Slopes - Varies, typically 1 vertical on 1.5 horizontal downstream; upstream side slope could not be determined. A typical section is shown on PLATE 4.

Zoning - Unknown.

Impervious Core - Unknown.

Cutoff - Unknown.

Grout curtain - Unknown.

h. Diversion and Regulating Tunnel: None.

i. Spillway.

(1) Type - Earth/rock channel

(2) Length of weir - Not applicable

(3) Crest elevation - 696.8

j. Regulating Outlets. None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN.

No design data were found to be readily available.

2.2 CONSTRUCTION.

The dam was built in 1958 by the previous owner. Plans for the construction of the dam were prepared but the present owner was unable to locate the design plans. The location of the previous owner is not known.

2.3 OPERATION.

The maximum reservoir loading on the dam is not known. All releases are through an uncontrolled spillway

2.4 EVALUATION.

a. Availability. No design or construction data were available.

b. Adequacy. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dam" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for the appropriate loading conditions and made a matter of record.

c. Validity. No valid engineering design data of construction data were available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the dam, outlet spillway and exit channel was made on 7 September 1978 by Corps of Engineers, St. Louis District personnel. The owner, Mr. Anderson, accompanied the inspection team. Very little information was available concerning construction of the dam.

b. Project Geology.

(1) The Anderson Lake Dam and drainage area is underlain by the Ordovician Jefferson City formation. Bedrock exposed in the spillway is light brown to cream, fine grained, thinly bedded dolomite with a moderately spalled surface. The bedding is essentially horizontal. The rock surface was slightly jointed by a set of short, closely spaced, relatively tight NW-SE trending joints. The bedrock exposed in the spillway was the only rock outcrop found in the entire drainage area, the remainder being covered by thin, cherty Jefferson City-Cotter residuum.

(2) The dam is located approximately 3 miles northeast of the northern edge of the Valle Mines - Vineland fault zone. The last major movement along this fault zone has been described as being post-Ordovician (440 million years before present), and it is not considered to be active. No evidence of faulting or other tectonic activity was observed in the area of the dam.

(3) No evidence of karst or other solution activity was found in the drainage area. On the right abutment, a small amount of water was observed seeping from the rock-embankment interface at the downstream edge of the spillway near the toe of the dam. On the left abutment, a small springhouse was located approximately 50 feet downstream of the toe of the dam; however, no artesian flow was apparent.

c. Dam.

(1) The dam is an earth embankment composed of brown silty clay. The dam is heavily vegetated and has scattered trees 3 inches in diameter and less growing on the downstream slope. The upstream slope is covered with willow trees that are less than 3 inches in diameter. These root systems constitute a potential seepage hazard. The crown has thick grass cover and is occasionally mowed. No detrimental settlement, cracking or sinkholes were observed in or near the earth embankment.

(2) No animal burrows were noted in the embankment. However, the thick vegetation provides animal habitat which increases the likelihood of animal burrows.

(3) No riprap exists on the upstream slope of the dam. However very little erosion has taken place on the upstream slope due to wave action.

(4) The downstream alope varies, typically 1 vertical on 1.5 horizontal. The upstream slope could not be determined.

(5) Marshy areas with standing water were observed approximately 25 feet downstream of the toe of the dam. A spring was observed seeping from the rock outcrop located at the right abutment of the dam.

(6) Surface drainage from the left side of the lake has caused minor erosion near the left abutment and dam embankment. Gullies were observed to be 8 inches deep. Erosion of the downstream slope of the dam is very minimal, if any.

d. Appurtenant Structures. The only appurtenant structure was the spillway which discharges over a series of rock falls to reach the original channel. No obstructions were observed in the spillway area and growth of vegetation is very minimal.

e. Reservoir Area. No pertinent problems were noted in any of the reservoir area.

f. Downstream Channels. The downstream channel has a marshy area with brush and trees growing along the downstream channel.

3.2 EVALUATION.

None of the conditions observed on the dam pose a serious threat to its stability. Maintenance of the downstream and upstream slope should be performed to discourage animal burrowing and to eliminate tree-root systems both of which could lead to seepage problems.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES.

There are no controlled outlet works for this dam; therefore, no regulating procedures exist. The pool is controlled by rainfall, runoff, evaporation, and capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM.

Based on the amount of brush and size of trees on the upstream and downstream slopes, it has been several years since the vegetation has been cut.

4.3 MAINTENANCE OF OPERATING FACILITIES.

No operating facilities exist.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT.

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION.

If the uncontrolled vegetation on the slopes are allowed to continue, potential problems may develop.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES.

a. Design Data: No design data were made available to the inspection team. All releases are nonregulated.

b. Experience Data: All of the pertinent data furnished in this report were derived from U. S. Geological Survey 7½ Minute Quadrangle Sheets or from measurements and surveys made during this inspection.

c. Visual Observations:

(1) A spring was observed seeping from the rock outcrop located at the right abutment of the dam.

(2) Trees and brush are growing on the dam embankment.

d. Overtopping Potential:

(1) The spillway is too small to pass the minimum required flood of one-half of the Probable Maximum Flood (PMF) without overtopping. The PMF is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway is capable of passing 20 percent of the PMF without overtopping. Routing 50 percent of the PMF through the reservoir indicated the dam will be overtopped by a flow of 900 cfs at a depth of .7 foot for approximately 45 minutes. The PMF would result in an overtopping flow of 2,100 cfs, a depth of 1.3 feet for a duration of five hours.

(2) The effects from rupture of the dam could extend approximately three miles downstream of the dam. There are three houses and one mobile home immediately downstream of the dam in addition to a group of farm buildings, one improved road crossing and two unimproved crossings within three miles of the dam. Should failure of the dam occur, these buildings could be severely damaged and the lives of any inhabitants lost.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY.

a. Visual Observations. Visual observations of conditions which adversely affect the structural stability of this dam are discussed in Section 3.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam were found available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Operating Records. No appurtenant structures requiring operation exist at this dam.

d. Post Construction Changes. No post construction changes were reported.

e. Seismic Stability. The dam is located in seismic zone 2, for which the recommended guidelines assign a "moderate" damage probability. Since detailed information on the properties of the materials in the embankment is not available, an accurate seismic evaluation cannot be made. The clayey materials used in the embankment minimize the likelihood of failure due to an earthquake.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT.

a. Safety. Several items are deficient which should be corrected. No erosion protection exists on the upstream slope of the dam. Erosion protection should be provided in the area of downstream slope of the left abutment. Exit channels are not sufficiently protected against erosion. Trees and bushes on the embankments provide a potential seepage hazard and animal habitat.

b. Adequacy of Information. The statements and recommendations in this report are based on visual observations and verbal discussions. Seepage and stability analyses are not on record as prescribed in the recommended guidelines.

c. Urgency. It is recommended that the remedial measures listed in Section 7.2 be accomplished in the near future.

d. Need for Phase II. No Phase II inspection is recommended. Action should begin on the remedial actions discussed in this report.

7.2 REMEDIAL MEASURES.

The following remedial measures are recommended:

a. Remove trees and cut-bushes on the upstream and downstream slopes and reestablish with grass cover. Holes created by the removal of trees should be suitably backfilled.

b. Fill any animal burrows found during clearing.

c. Spillway size and/or height of dam should be increased to pass the probable maximum flood without overtopping the dam.

d. Provide erosion protection from surface runoff at the left abutment and downstream slope.

e. Realine the exit channel to direct flow from the toe of the embankment.

f. A stability and seepage analysis of the dam should be performed by a professional engineer experienced in the design and construction of dams.

APPENDIX A

HYDROLOGIC COMPUTATIONS

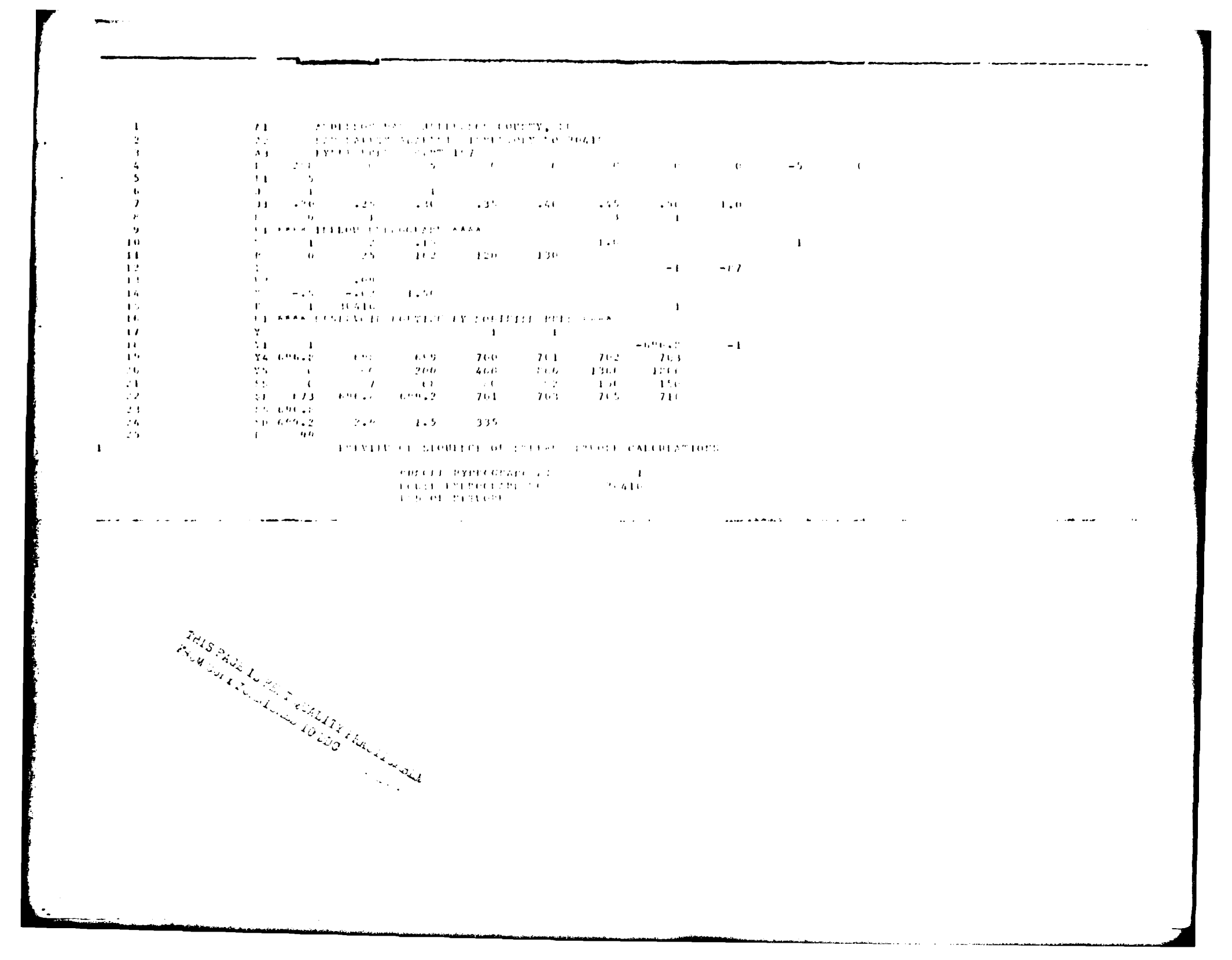
HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with the total rainfall depth distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the spillway, and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The hydraulic capacity of the outlet works, spillway, and top of dam are defined by elevation-discharge curves.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above analysis has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed in the attached computer printout. Definitions of these variables are contained in the "User's Manual" for the computer program.



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1.01	1.35	19	.01	0.00	.01	0.	1.01	13.35	163	.26	.25	.00	290.
1.01	1.40	20	.01	0.00	.01	0.	1.01	13.40	164	.26	.25	.00	290.
1.01	1.45	21	.01	0.00	.01	0.	1.01	13.45	165	.26	.25	.00	291.
1.01	1.50	22	.01	.00	.01	0.	1.01	13.50	166	.26	.25	.00	291.
1.01	1.55	23	.01	.00	.01	0.	1.01	13.55	167	.26	.25	.00	291.
1.01	2.00	24	.01	.00	.01	0.	1.01	14.00	168	.26	.25	.00	291.
1.01	2.05	25	.01	.00	.01	1.	1.01	14.05	169	.32	.31	.00	316.
1.01	2.10	26	.01	.00	.01	1.	1.01	14.10	170	.32	.31	.00	347.
1.01	2.15	27	.01	.00	.01	1.	1.01	14.15	171	.32	.31	.00	359.
1.01	2.20	28	.01	.00	.01	1.	1.01	14.20	172	.32	.31	.00	364.
1.01	2.25	29	.01	.00	.01	2.	1.01	14.25	173	.32	.31	.00	365.
1.01	2.30	30	.01	.00	.01	2.	1.01	14.30	174	.32	.32	.00	365.
1.01	2.35	31	.01	.00	.01	2.	1.01	14.35	175	.32	.32	.00	366.
1.01	2.40	32	.01	.00	.01	2.	1.01	14.40	176	.32	.32	.00	366.
1.01	2.45	33	.01	.00	.01	3.	1.01	14.45	177	.32	.32	.00	366.
1.01	2.50	34	.01	.00	.01	3.	1.01	14.50	178	.32	.32	.00	366.
1.01	2.55	35	.01	.0	.01	3.	1.01	14.55	179	.32	.	. 0	367.
1.01	3.00	36	.01	.00	.01	3.	1.01	15.00	180	.32	.	.00	367.
1.01	3.05	37	.01	.00	.01	3.	1.01	15.05	181	.39	.39	.00	367.
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1.01	3.15	39	.01	.00	.01	3.	1.01	15.15	183	.39	. 3	.	367.
1.01	3.20	40	.01	.	.01	3.	1.01	15.20	184	.39	.38	. 0	367.
1.01	3.25	41	.01	.00	.01	3.	1.01	15.25	185	.39	.38	.00	367.
1.01	3.30	42	.01	.00	.01	3.	1.01	15.30	186	1.05	1.04	.01	1111.
1.01	3.35	43	.01	.00	.01	3.	1.01	15.35	187	2.21	2.20	.01	2222.
1.01	3.40	44	.01	.0	.01	3.	1.01	15.40	188	1.07	1.01	.05	1111.
1.01	3.45	45	.01	.0	.01	3.	1.01	15.45	189	.0	.	. 0	1111.
1.01	3.50	46	.01	.	.01	3.	1.01	15.50	190	.39	.38	.01	1111.
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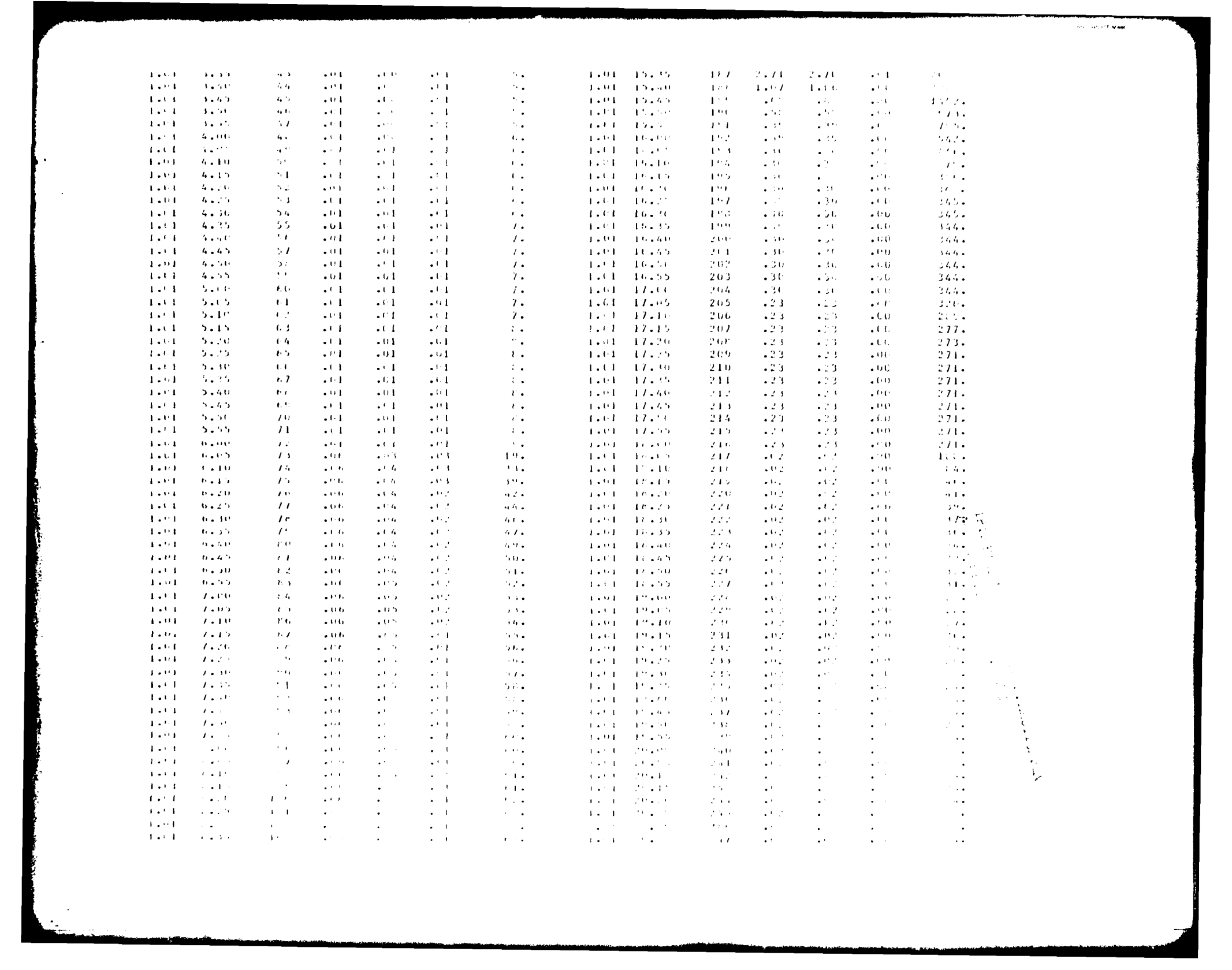
1.01	.00		.01		.01								



SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	STORAGE	0.	0.	240.
	OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE (AC-FT)	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	699.19	0.00	0.	231.	0.00	15.83	0.00
.25	699.37	.19	69.	353.	.33	15.75	0.00
.30	699.52	.32	70.	482.	.42	15.75	0.00
.35	699.63	.43	71.	595.	.50	15.75	0.00
.40	699.71	.51	71.	697.	.58	15.75	0.00
.45	699.81	.61	72.	824.	.67	15.67	0.00
.50	699.90	.70	73.	960.	.75	15.67	0.00
1.00	700.51	1.31	77.	2063.	4.92	15.67	0.00

```
1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION       JULY 1978
   TEST EXECUTATION  12 SEP 79
 **********************************

101.
102
COMPUTE
 JOB PROCESSING COMPLETE      0.790
EXIT  79/09/12. 06.35.38.
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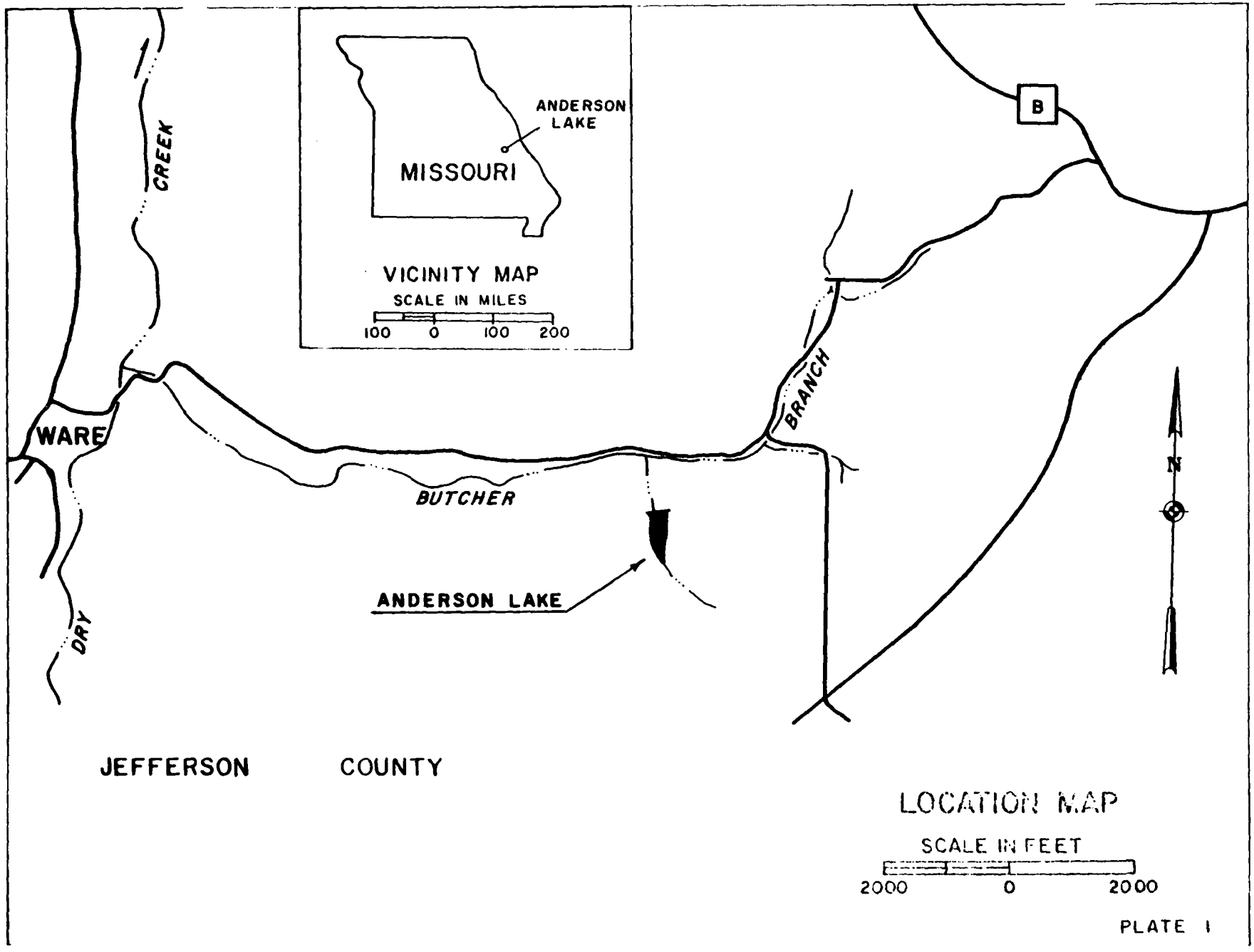
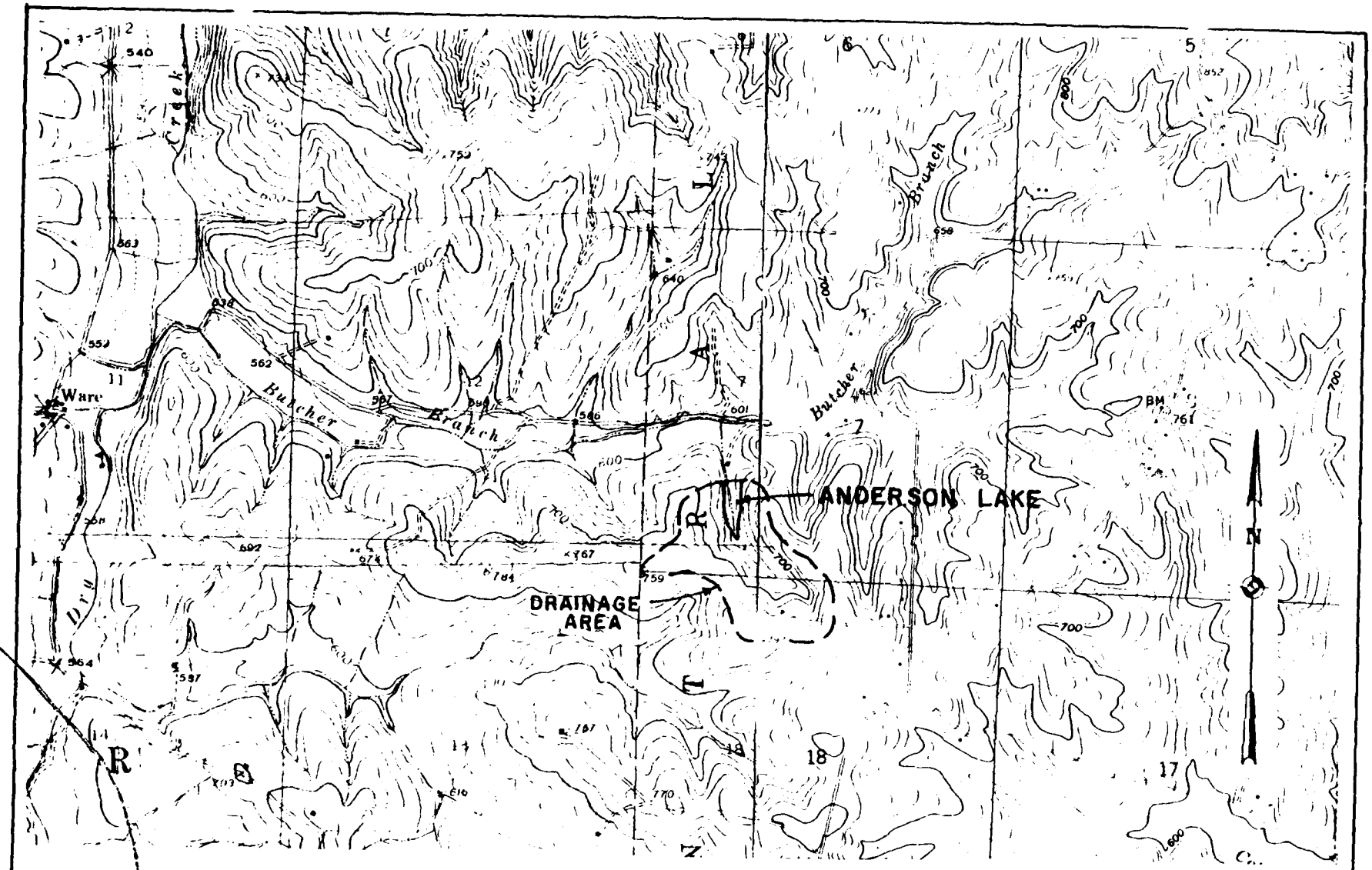
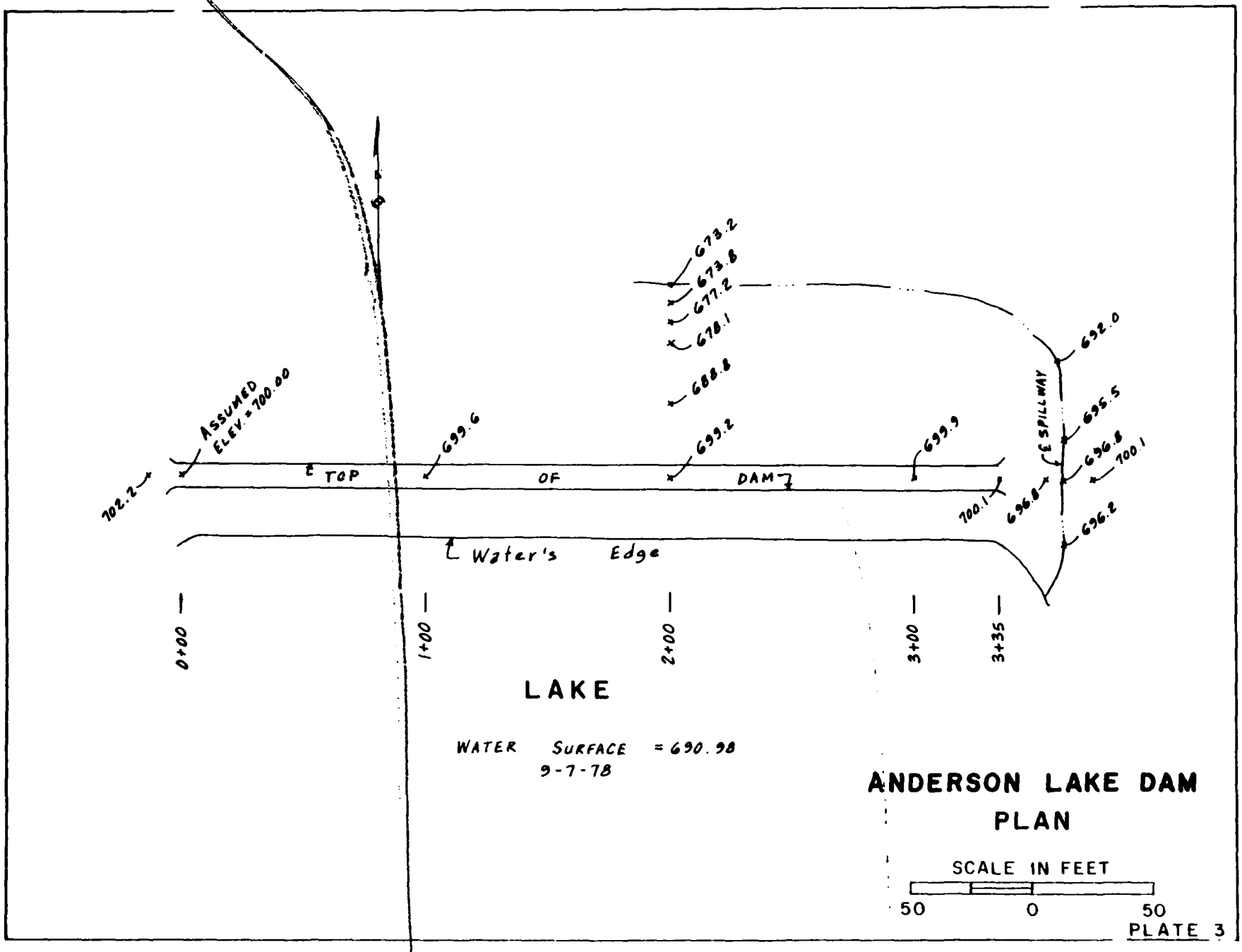

ANDERSON LAKE
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
CREEK
B
BRANCH
WARE
BUTCHER
ANDERSON LAKE
DRY
N
JEFFERSON COUNTY
LOCATION MAP
SCALE IN FEET
2000 0 2000
PLATE 1

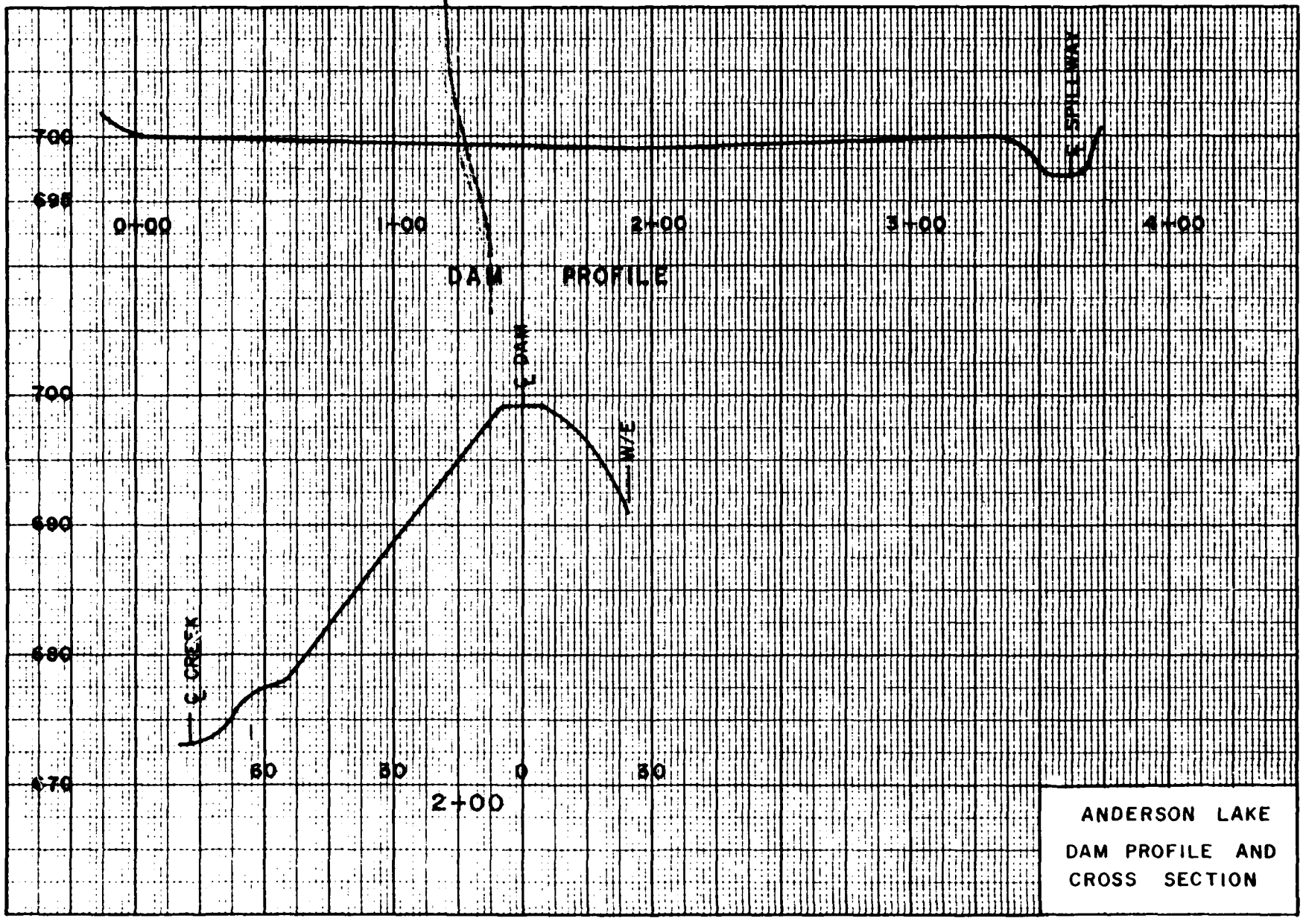


ANDERSON LAKE

VICINITY TOPOGRAPHY

PLATE 2


673.2
673.8
677.2
678.1
688.8
692.0
695.5
696.8
700.1
696.2
ASSUMED ELEV. = 700.00
702.2
699.6
699.2
699.9
700.1
696.8
℄ SPILLWAY
℄ TOP OF DAM
℄ Water's Edge
0+00
1+00
2+00
3+00
3+35
LAKE
WATER SURFACE = 690.98
9-7-78
ANDERSON LAKE DAM
PLAN
SCALE IN FEET
50
0
50
PLATE 3



ANDERSON LAKE

DAM PROFILE AND CROSS SECTION

PLATE 4

PHOTO 1: UPSTREAM VIEW OF LAKE

PHOTO 2: DOWNSTREAM VIEW FROM DAM

PHOTO 3: DOWNSTREAM FACE OF DAM AND SPILLWAY

PHOTO 4: UPSTREAM FACE OF RIGHT ABUTMENT AND SPILLWAY

PHOTO 5: DOWNSTREAM VIEW OF SPILLWAY

PHOTO 6: UPSTREAM VIEW OF SPILLWAY

PHOTO 7: OVERBANK NEAR RIGHT ABUTMENT, DOWNSTREAM [illegible]

PHOTO 8: [illegible]